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Software defined network control for LHC Experiments

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The Large Hadron Collider (LHC) experiments rely on a diverse network of National Research and Education Networks (NRENs) to distribute their data efficiently. These networks are treated as “best-effort” resources by the experiment data management systems. Following the High Luminosity upgrade, the Compact Muon Solenoid (CMS) experiment is projected to generate approximately 0.5 exabytes of data annually. The seamless operation of NRENs is crucial for the success of CMS and other LHC experiments. However, challenges arise during data movement as NRENs lack awareness of data transfer priorities, importance, or quality of service requirements and NRENs operators can not ensure predictable data flow rates across multi-domain networks. Our work focuses on SENSE, The Software-defined network for End-to-end Networked Science at Exascale, and Rucio, data management software used by multiple experiments, to allocate and prioritize specific data transfers across the wide area network. In this paper, we will showcase our advancements since the last publication, sharing insights gained and detailing the enhancements made to the software stack. These improvements enable science experiments to treat networks as first-class citizens and effectively utilize, prioritize, and manage wide area networks to sites.

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